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Final
Remedial Action Work Plan

McCormick & Baxter Creosoting Company
Portland Plant
Portland, Oregon

Task Order No.: 64-93-23

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Prepared for:

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List of Acronyms

ACL	Alternate concentration limit
ACZA	Ammoniacal copper zinc arsenate
AQUIP	Aquifer Investigation Plan
BGS	Below ground surface
BNRR	Burlington Northern Railroad
BTTP	Biological Treatment Test Plan
CCB	Construction Criteria Base
CCI	Construction Specification Intact
cfs	Cubic feet per second
CQA	Construction Quality Assurance
CRP	Community Relations Plan
DEQ	Department of Environmental Quality
DMP	Data Management Plan
DNAPL	Dense non-aqueous phase liquid
DQO	Data quality objectives
E & E	Ecology and Environment, Inc.
EPA	United States Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FS	Feasibility Study
FWDA	Former Waste Disposal Area
GIS	Geographic Information System
HSP	Health and Safety Plan
IRA	Interim remedial action
LNAPL	Light non-aqueous phase liquid
mph	Miles per hour
MSL	Mean Sea Level
NAPL	Non-aqueous phase liquid
NGVD	National Geodetic Vertical Datum
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
ODC	Other direct costs
PAH	Polycyclic aromatic hydrocarbon
PCP	Pentachlorophenol
QA/QC	Quality Assurance/Quality Control
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision

List of Acronyms (Cont.)

SMP	Site Management Plan
SQAP	Sampling and Quality Assurance Plan
TCLP	Toxicity characteristic leaching procedure
TFA	Tank Farm Area
TOC	Total Organic Carbon
UPRR	Union Pacific Railroad
USACE	United States Army Corps of Engineers

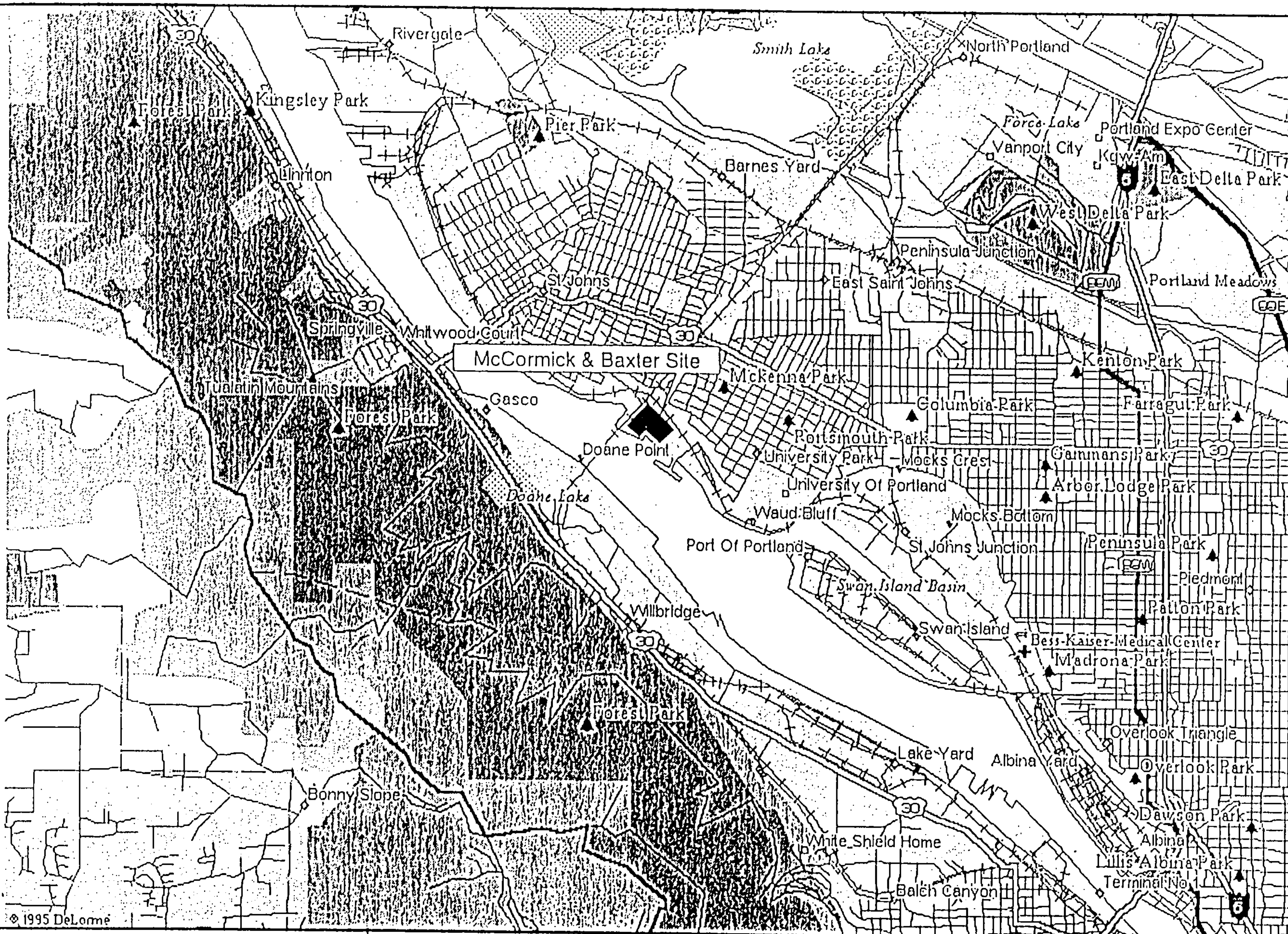
1 Introduction and Purpose

Ecology and Environment, Inc. (E & E), under contract with the Oregon Department of Environmental Quality (DEQ), has prepared this Work Plan for remedial action (RA) activities at the McCormick & Baxter Creosoting Company Portland Plant (McCormick & Baxter) site in Portland, Oregon. The site, a former wood-treating facility, is located along the Willamette River at 6900 North Edgewater Street (Figure 1-1). This document has been prepared under Task Order No. 64-93-23. The purpose of this task order is to conduct remedial design (RD) and remedial action (RA) activities at the site in accordance with the remedies described in the Record of Decision (ROD) dated March 1996 (EPA 1996).

This RA Work Plan describes the scope of RA tasks to be conducted at the McCormick & Baxter site that relate to implementation of the groundwater remedy only. At this time, remediation of the soil and sediment are not included in this Work Plan because RD activities for these media are not complete. An addendum to this RA Work Plan or separate RA Work Plans will be prepared for the soil and sediment remedies when RD activities are complete.

Currently, groundwater RAs are being conducted at the site by E & E in accordance with the Pre-Remedial Design Work Plan (E & E 1996a). The current groundwater RAs consist of:

- Non-aqueous phase liquid (NAPL) extraction via total fluids pumping (pumping both groundwater and NAPL simultaneously) in the Tank Farm Area (TFA);
- Treatment of groundwater (from the extraction system) utilizing a pilot dissolved air floatation (DAF) water treatment system followed by granular activated carbon polishing;
- Pure-phase NAPL measurement and extraction from existing monitoring wells in the TFA and Former Waste Disposal Area (FWDA);
- Quarterly groundwater sampling from an established well network;



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0 .5mi 1 mile
Approximate Scale in Miles

FIGURE 1-1

SITE LOCATION MAP

Drawn By:	Date	IDD/Job No.	Dwg. No.
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- Groundwater elevation and Willamette River stage level monitoring; and
- Site security and maintenance.

These current groundwater RAs do not sufficiently meet the goals and objectives of the groundwater remedy defined in the ROD. To achieve and implement the full groundwater remedy, enhancements to the existing groundwater RA are required. This RA Work Plan provides a description of the activities that E & E will complete to enhance the existing groundwater RA.

This Work Plan provides a discussion of the nature and extent of groundwater contamination (Section 2); a description of the remedial action objectives (RAOs) and data gaps (Section 3); identification of E & E's RA implementation approach and each RA task (Section 4); reporting requirements and list of deliverables (Section 5); project organization (Section 6); project schedule (Section 7); and references (Section 8).

2 Nature and Extent of Groundwater Contamination

The current configuration of the site and a description of the source areas and nature and extent of contamination are discussed in detail in the Remedial Investigation (RI) Report (PTI 1992a), the ROD (EPA 1996), and the quarterly reports. A summary of this information as it pertains to groundwater is presented in this section.

2.1 Geologic and Hydrogeologic Conditions

The Portland Basin is bounded by the Cascade Range to the east, the Portland Hills to the west, the Lewis River to the north, and the Clackamas River to the south. The McCormick & Baxter site is located on a terrace of dredged sand fill adjacent to the Willamette River within the Portland Terraces, a physiographic subunit of the Portland Basin. These terraces were formed by the ancestral Columbia and Willamette Rivers during a time when the rivers were flowing at higher elevations than at present.

The Portland Basin is filled with Quaternary alluvial deposits, catastrophic flood sediments deposited during the Pleistocene, and undifferentiated sediments deposited during the Pliocene (Beeson 1989). These sediments overlie the Columbia River Basalt and the older Waverly Heights Basalt.

Pleistocene fluvial deposits occur from the ground surface to a depth of approximately 20 to 75 feet below ground surface (BGS) in the site vicinity. The channel sediments consist of interlayered silts, sands, and gravels deposited during major flood events.

Undifferentiated sediments (Pliocene to Holocene), including the Troutdale Formation, lie beneath the Pleistocene fluvial deposits. Total thickness of these sediments may exceed 200 feet. The Troutdale Formation consists of consolidated and unconsolidated sand and gravel deposits, which are cemented in places. Silt and clay layers within the Troutdale Formation are not typically laterally continuous.

Four hydrostratigraphic units are present at the site, and within these units a shallow, an intermediate, and a deep aquifer zone are present, which are interconnected to varying degrees depending on the location within the site.

The shallow, unconfined, sand-fill aquifer is present across the entire site, and ranges in thickness from about 5 feet to greater than 30 feet. Depth of groundwater ranges from approximately 20 to 25 feet BGS. The base of the shallow aquifer is typically defined by a silt layer aquitard that ranges in thickness from 0 to greater than 100 feet. The silt aquitard is thickest near the central portion of the site (i.e., in the TFA) and thins toward the Willamette River. At the Willamette River, the silt aquitard is truncated, and a thick sequence of poorly-graded sands extends from ground surface to at least 80 feet BGS. In this area, the aquifer zones are hydraulically connected and form an single continuous unconfined aquifer near the river boundary. Depth intervals along the river are referred to as the shallow, intermediate, and deep zones of this aquifer, but separate landward into distinct units.

The intermediate aquifer is composed of fine- to medium-grained alluvial sand and is typically present below a silt aquitard. The intermediate aquifer is not continuous over the entire site and varies in thickness from 0 to greater than 50 feet. In the central process area, the intermediate aquifer is approximately 12 feet thick and hydraulically separated from the shallow aquifer. In the TFA, the silt aquitard is greater than 100 feet thick and no intermediate aquifer is present. In other portions of the site, the intermediate zone is separated from the shallow zone by a thin silt aquitard. In these areas, the intermediate and deep zones are not separated by a continuous confirming layer and apparently are in hydraulic connection.

The deep aquifer zone is present in all portions of the site. As previously discussed, the deep zone for the majority of the site is in alluvial sands and is directly connected with the intermediate and shallow zones along the river margin. Near the center of the site, the deep zone is separated from the shallow zone by more than 100 feet of low-permeability silt. Near the bluff, the deep aquifer is composed of sand and cemented gravel zones of the Troutdale Formation and Catastrophic Flood Deposits. It is not known exactly where the transition of the Troutdale Formation and the alluvial sands and silts is located, although shallow groundwater gradients generally exist from the bluff toward the river. Intermediate and deep zone groundwater surface elevations and gradients have been inferred to flow toward the river in these zones.

The City of Portland supplies drinking water to residential areas in north Portland, including the site. The source of this drinking water is the Bull Run Reservoir located approximately 40 miles east of Portland. This water supply is supplemented by a well field in

East Multnomah County (approximately 10 miles east of the site) that uses deep aquifers in the Troutdale Formation. The only current use of groundwater in the vicinity of the site is by the University of Portland, which operates a supply well for irrigation. This supply well is completed in the deep aquifer, which has not been affected by the site.

2.2 Nature and Extent of Groundwater Contamination

The primary contaminants of concern in site groundwater are polycyclic aromatic hydrocarbons (PAHs), pentachlorophenol (PCP), and metals associated with wood-treating solutions. Chemicals used in the wood-treating process are commonly not very soluble in water or generally have low solubilities. The pure-phase wood-treating compounds, when released to the subsurface, either float on the groundwater table or sink, depending on the density of the compounds compared to that of water. These immiscible liquids are commonly described as non-aqueous phase liquids (NAPLs). NAPL that is lighter than water (i.e., floats) is referred to as LNAPL, and NAPL that is heavier (i.e., has a higher density) than water and sinks is referred to as DNAPL. Groundwater quality at the site has also been impacted by dissolved-phase contaminants.

Releases of NAPL contaminants from the main source areas at the site, in particular the TFA and FWDA, have primarily affected the shallow and intermediate aquifer zones. As the pure-phase NAPL has migrated horizontally toward the river, it has also spread downward vertically. Two distinct NAPL plumes are present at the site, one in the TFA and the other in the FWDA. These contaminant plumes contain pure-phase LNAPL and DNAPL, as well as dissolved-phase contaminants. Smaller NAPL plumes are present near MW-1 and the former location of Butt Tank 1 near the southeast disposal trench.

DEQ has installed a monitoring well network (see Figure 2-1) to delineate areas of pure-phase and dissolved-phase organic and inorganic contamination. In addition to groundwater sampling conducted during the RI in 1991 and 1992 and post-RI sampling in 1994, DEQ began conducting quarterly groundwater quality monitoring in January 1996. Samples are routinely collected from wells completed in the shallow, intermediate, and deep groundwater zones at the site. Quarterly groundwater monitoring results, as well as other ongoing activities related to groundwater and NAPL extraction and treatment, are discussed in quarterly reports prepared by E & E. The most recent report for the third quarter of 1996 is entitled *Remedial Actions Quarterly Report, June 1996 - September 1996* (E & E 1996b).

2.3 Groundwater Contaminant Source Areas

Two primary groundwater contaminant source areas exist at the site: the FWDA and the TFA/Central Processing Area/Southeast Disposal Trench. A secondary groundwater contaminant source area exists in the monitoring well MW-1 area. Each of these areas contains pure-phase and dissolved-phase contamination in the groundwater. These major source areas are discussed in the following sections.

2.3.1 Former Waste Disposal Area

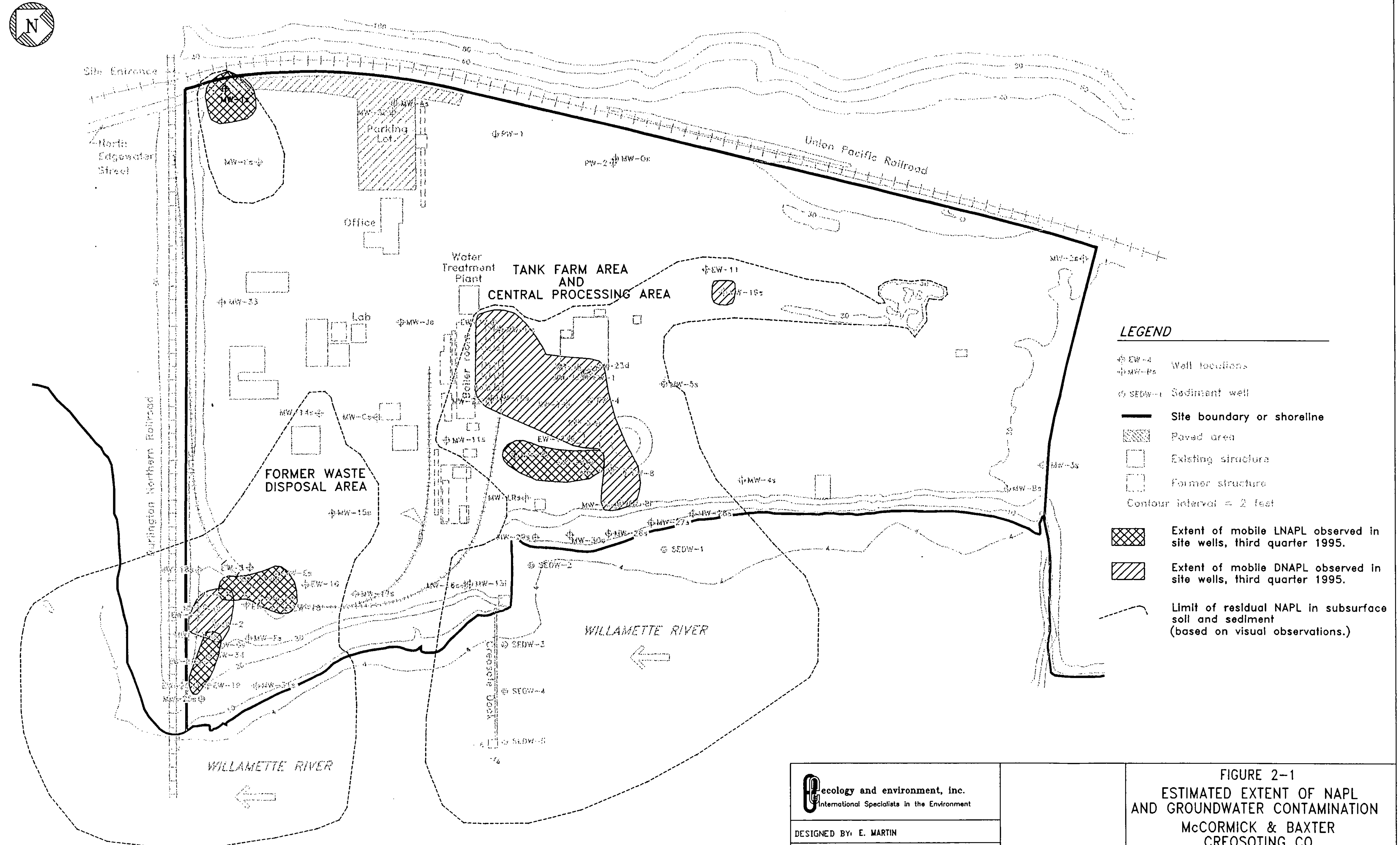
The FWDA NAPL plume affects approximately 4 acres of soil and 5 acres of sediment (see Figure 2-1). The origin of this plume is waste oils, storm water from system pits, and other liquid wastes that were disposed in the FWDA. This mixture migrated vertically to the groundwater table (approximately 30 feet BGS) and then laterally toward the river and vertically, as both a LNAPL and a DNAPL phase. No confining unit has been observed in the FWDA to stop downward migration of DNAPL. Monitoring and extraction wells installed in the FWDA have contained up to 8 feet of LNAPL and 21 feet of DNAPL, with visible NAPL present in soil samples collected at depths up to 88 feet.

2.3.2 TFA/Central Processing Area/Southeast Disposal Trench Area

The TFA plume affects approximately 8 acres of soil and 6 acres of sediment (see Figure 2-1). The origin of this plume is the former tank farm, large creosote tank, creosote retorts, subsurface product lines, butt tanks, and southeast waste disposal trench, which either had periodic spills or were used for disposal of waste oils (creosote and PCP) and other liquid wastes. This mixture migrated vertically to the groundwater table (approximately 30 feet BGS) and then laterally toward the river and vertically, spreading as both a LNAPL and a DNAPL phase. A confining layer is present under part of the TFA, and DNAPL has been observed to accumulate. Near the beach, LNAPL has been observed as seeps at low tides and low river stage, generally during late summer. Monitoring wells and extraction wells installed in the TFA have contained up to 3 feet of LNAPL and 10 feet of DNAPL, with visible NAPL present in soil samples collected at depths up to 62 feet BGS.

2.3.3 Monitoring Well MW-1

Viscous LNAPL found in MW-1 located near the entrance to the property contains 26-percent total aliphatic hydrocarbons. This NAPL has been characterized as Bunker-range hydrocarbons. The source of this NAPL cannot be directly attributed to site-related releases and is still unknown.



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NO.	DATE	DWN	APP'D	DESCRIPTION

REVISIONS

FIGURE 2-1
ESTIMATED EXTENT OF NAPL AND GROUNDWATER CONTAMINATION
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SCALE	DATE ISSUED	CAD FILE NO.	DRAWING NO.
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3 Remedial Action Objectives and Data Gaps

This section describes the selected RAOs and cleanup goals for groundwater and provides a discussion of the primary data gaps that need to be addressed to effectively implement the groundwater RA enhancements.

3.1 Groundwater Remedial Action Objectives

The RAOs for groundwater are to prevent human exposure to or ingestion of contaminated groundwater, contain the NAPL plumes, minimize ongoing discharges of NAPL to the Willamette River, and minimize further contamination of the intermediate and deep aquifers. To accomplish these RAOs, the selected groundwater remedy entails extraction of pure-phase NAPL and NAPL-contaminated groundwater, treatment of extracted groundwater, discharge of treated groundwater, off-site disposal of collected NAPL and treatment system residuals, aquifer and river monitoring, institutional controls, and a contingency for a physical barrier between mobile NAPL pools and the Willamette River. The groundwater remedy will include the following major components:

- Enhanced NAPL recovery using pure-phase extraction and/or groundwater/NAPL extraction;
- Evaluation by pilot testing of innovative technologies, such as water flooding, steam injection, or surfactant flushing, to increase the effectiveness and the rate of NAPL removal;
- Treatment of groundwater using methods such as dissolved air floatation, filtration, carbon absorption, extended aeration/packed bed bioreactor, or other biological treatment;
- Discharge of treated groundwater to the Willamette River in accordance with substantive NPDES requirements (Table 3-1), or alternatively discharge to drainfields installed in major source areas for enhanced NAPL recovery (injection wells/trenches) if soil permeability is adequate based on field test results;

Table 3-1

NPDES DISCHARGE LIMITS[a]

Parameter	Monthly Average	Daily Maximum
Flow		43,200 gallons/day[b]
Arsenic (total)	80	120
Chromium (IV)[c]	19	28
Chromium (III)	350	500
Copper	20	30
Zinc	190	280
Pentachlorophenol[d]	22	33
Total PAHs[e]	1,700	2,500
pH	6.5 - 8.5 SU	6.5 - 8.5 SU

a All units in micrograms per liter (μg/L) unless otherwise noted.
b Equivalent to 30 gallons per minute over a continuous 24-hour period.
c Hexavalent chromium need not be analyzed if chromium III is below limits for hexavalent chromium.
d DEQ has established a total maximum daily load tetrachlorodibenzo-p-dioxins (TMDL) and waste load allocation (WLA) for discharges to the Willamette River of 2,3,7,8-tetrachlorodibenzodioxins (TCDD). A 5 μg/day WLA has been established for NPDES discharges from the site, which will be met through compliance with pentachlorophenol discharge limits.
e Sum of all detected PAHs.

- Off-site treatment and/or disposal of NAPL and other treatment residuals in accordance with applicable hazardous waste regulations;

- Monitoring to ensure that site-specific alternate concentration limits (ACLs) (Table 3-2) are met at compliance monitoring locations;

- A contingency to install a vertical physical barrier in the event that:
  - The mobile NAPL cannot be reliably controlled using hydraulic methods; or
  - It improves the overall efficiency and cost-effectiveness of the groundwater remedy; and

- Institutional and permitting controls restricting groundwater use at the site.

3.2 Groundwater Remedial Action Technical Issues

Current groundwater RAs (which commenced as interim remedial actions [IRAs] and have continued into the RA phase) include enhanced NAPL extraction from three wells in the Tank Farm Area (TFA) and pure-phase NAPL extraction conducted manually at select wells in the TFA and Former Waste Disposal Area (FWDA). Groundwater and NAPL removed from the wells as part of the enhanced NAPL extraction process are treated in the existing pilot treatment system before the water is discharged to the Willamette River. Pure-phase NAPL is manually collected and placed into a sludge tank for storage until off-site disposal. The groundwater treatment system is a pilot scale plant with treatment capacity of 10 gallons per minute (gpm) over a 40-hour work week. The system includes dissolved air floatation using chemical polymer additives, filtration, and carbon absorption treatment components. This system is not automated and requires a technician to monitor and adjust the system on a continual basis (the system currently operates approximately 8 hours/day, 5 days/week).

The groundwater RAs currently being conducted at the site do not attain the RAOs; therefore, modifications and enhancements to the current RAs are required. In order to implement RA enhancements, additional investigatory activities, discussed in the following sections, will be conducted. These investigation activities will generate increased volumes of NAPL and contaminated groundwater. This NAPL and contaminated groundwater will require treatment prior to disposal; however, the existing treatment system does not have sufficient capacity to handle the additional volume.

To address this problem, E & E prepared a technical memorandum to DEQ dated September 12, 1996, which outlines the rationale for installing a second treatment system at the site in the FWDA. The memo describes two options that would allow investigatory and remedial activities to be conducted in the FWDA: a pipeline to the existing treatment system or installation of a second treatment system consisting of an oil/water separator, filter, and

Table 3-2

ALTERNATE CONCENTRATION LIMITS FOR GROUNDWATER (SHALLOW AQUIFER)

Analyte	Groundwater Concentration (mg/L)[a]
Total PAHs[b]	43
Pentachlorophenol	5
Dioxins/Furans[c]	2×10^{-7}
Arsenic(III)	1
Chromium(III)	1
Copper	1
Zinc	1

a Based on aqueous solubility and consideration of groundwater/surface water dilution.
b Sum of low and high molecular weight PAHs.
c Based on solubility and toxic equivalency to 2,3,7,8-TCDD.

granular activated carbon vessels. The second treatment system was selected by DEQ, and EPA and E & E developed a design and subcontractor scope of work to construct and install the system. The system is scheduled for installation in March and April 1997.

Installation and operation of the FWDA treatment system will allow investigation of the technical issues identified below, as they relate to implementing full-scale groundwater RAs at the site. The technical issues are presented in this work plan to provide the framework for future, detailed investigatory work plans, sample plans, and site tests. A summary of existing groundwater data and specific data gaps will be developed by E & E and presented in future site plans (see Section 4.2.2).

3.2.1 Enhanced NAPL Extraction

Current enhanced NAPL extraction consists of groundwater extraction from three wells (EW-1, EW-4, and EW-7) located in the TFA. Groundwater extraction is conducted at a low flow rate (2 to 4 gpm) to allow concurrent NAPL extraction. Based on periodic groundwater elevation measurements in surrounding monitoring wells, no hydraulic control or areas of influence in the TFA are established with these groundwater extraction rates. Two of the extraction wells are equipped with electric centrifugal pumps; the remaining well is equipped with a pneumatic, positive displacement, bladder pump. The combined groundwater and NAPL is pumped to the pilot treatment system where the NAPL is separated from the water in the form of flocculent sludge. The enhanced NAPL extraction pumps are only operated when the pilot treatment system is in operation (8 hours/day, 5 days/week). Continuous enhanced NAPL extraction and treatment is not currently conducted at the site. Enhanced NAPL extraction has not been conducted in the FWDA or MW-1 area.

The current enhanced NAPL extraction activities do not accomplish the RAOs for groundwater. To attain the RAOs, expansion of the enhanced NAPL extraction activities in the TFA and full-scale implementation of enhanced NAPL extraction in the FWDA and MW-1 area are required. The current level of data and site information is insufficient for design and construction of a full-scale enhanced NAPL extraction system. The major technical issues associated with enhanced NAPL extraction that require resolution prior to design and construction of the full-scale system are summarized below. Additional details will be provided in the aquifer investigation plan (AQUIP).

- Determine if the existing well network is adequate and appropriate for implementation of the full-scale enhanced NAPL extraction and pure-phase extraction activities;

- Select the final enhanced NAPL extraction and pure-phase extraction wells and the resulting well network arrangement;
- Determined the optimum NAPL and groundwater extraction rates for each enhanced NAPL extraction and pure-phase extraction well;
- For each extraction well, determine the well characteristics such as radius of influence, drawdown, contaminant loading concentrations, etc.;
- Evaluate extraction well casing diameters and construction to determine if sufficient space is available for installation of pumping and monitoring equipment;
- Develop a measurement technique to determine the percent of NAPL in extracted groundwater for optimization of pumping actions;
- Determine the feasibility and effectiveness of single phase (NAPL), dual phase (NAPL/groundwater), and total fluids extraction equipment and techniques; determine the optimum combination of these techniques to attain the RAOs;
- Evaluate the original estimate of NAPL volume in FWDA, TFA, and MW-1 area contained in the revised Feasibility Study and incorporate new information to augment the estimate;
- Determine the mobility of the NAPL;
- Confirm the depth of the mobile DNAPL plume; and
- Develop a conceptual site model, amend the model with new information as it becomes available, and utilize computer modeling to assist with investigatory, design, and operation evaluation tasks.

3.2.2 Innovative NAPL Extraction Technologies

The ROD allows for the evaluation of innovative NAPL extraction technologies to augment the enhanced NAPL extraction and pure-phase NAPL extraction remedial actions at the site. Innovative NAPL extraction technologies include water flushing, steam injection, hot water injection, and surfactant injection (such as alcohols and/or detergents). These technologies are applied to the unsaturated soil with the intent of mobilizing NAPL that would be collected by the groundwater/NAPL collection system. E & E will evaluate innovative NAPL extraction technologies following full-scale implementation of the enhanced NAPL and pure-phase extraction activities. Evaluation of innovative NAPL extraction technologies will only be conducted after receiving DEQ approval, and only within an area of the site at which sufficient hydraulic control is present to prevent mobilization of NAPL into uncontaminated areas. Evaluation of innovative NAPL extraction technologies will begin when the volume of NAPL extracted with enhanced NAPL and pure-phase NAPL extraction techniques reach steady-state. E & E also will evaluate the location and quantity of NAPL in monitoring wells to determine if NAPL extraction activities are effective. Some of the technical issues that will be investigated and evaluated by E & E regarding implementation of innovative NAPL extraction technologies include:

- Mobility of the NAPL (e.g., wetability);
- Effectiveness of NAPL mobilization using water flushing, steam/hot water injection, and surfactant (alcohols/detergents); and
- Results of innovative NAPL extraction bench scale tests on soil cores and pilot tests within controlled areas of the site.

3.2.3 Groundwater Treatment

The current groundwater treatment system is a pilot system consisting of a holding tank that functions as an oil/water separator, a dissolved air floatation (DAF) unit, a second holding tank (Tank 2), particulate filters, and granular activated carbon (GAC) units. The system receives contaminated groundwater and NAPL from the TFA enhanced NAPL extraction system. The treatment system is not automated and does not operate on a continuous basis. The system is operated manually by the site technician for 8 hours per day, 5 days per week. The system is operated at the maximum flow rate of 10 gpm. The current treatment system does not have the capacity or control equipment to operate continuously at 30 gpm, the minimal flow rate specified in the ROD to achieve the groundwater RAOs.

During two quarterly sampling events at the site, water samples were collected at each state of the existing treatment process and analyzed to determine the system's treatment efficiency. E & E documented the results of these treatment train water samples in the first and third quarterly reports for 1996. The analysis indicated that approximately 60 percent of the contaminant removal occurred in the DAF, 20 percent of the contaminant removal occurred in Holding Tank 2, and 20 percent of the contaminant removal occurred in GAC units. At other sites contaminated with wood treating chemicals, biological treatment of contaminated groundwater has achieved removal efficiencies of up to 95 percent, with the remaining 5 percent removed in the GAC polishing unit. Therefore, a treatment process utilizing biological treatment and carbon polishing is expected to be more cost effective than a DAF/GAC system over the estimated period of performance (assumed to be 30 years). The primary cost savings occurs due to reduced carbon consumption and carbon disposal/ regeneration. Typically, costs associated with operating the primary treatment units (e.g., DAF and/or biological reactor) are likely to be similar; therefore, carbon costs are the controlling factor.

The ROD specifies two options for providing groundwater treatment at the site. The pilot system will either be enhanced to increase capacity and automated for continuous operation or replaced by a new system with a capacity of at least 30 gpm designed for continuous, automated operation. The ROD further specified that biological treatment may be incorporated into a new system to reduce the volume of wastes generated, such as sludge and spent activated carbon. Based on E & E's evaluation, the current pilot system cannot be readily enhanced and automated for continuous operation. Therefore, E & E recommends design and installation of a replacement system with higher capacity and continuous, automated operation. A review of the operating data from the current system indicated that it is too dependant on carbon adsorption for removal of organic contaminants. E & E recommends investigation of biological treatment to minimize the rate of carbon usage in the final treatment system.

In order to investigate biological treatment and design the new groundwater treatment system, the following technical issues require resolution prior to initiating the design activities:

- Determine if the site specific contaminants are toxic to microbes. If so, alternative technologies will be investigated such as groundwater pretreatment options, re-evaluation of DAF technology, activated sludge, carbon adsorption, etc.

- If site specific contaminants are not toxic to microbes, determine the effectiveness of biological treatment through pilot testing. If pilot testing indicates that favorable treatment efficiencies are not possible, then biological treatment will be eliminated from further consideration and alternate technologies will be investigated including re-evaluation of DAF technology.

- Determine the influent contaminant concentrations and flow rates that will be generated by the final extraction well network.

- Determine the expected size and removal efficiencies for final treatment system.

- Determine whether one system will provide treatment for the entire site, or whether individual systems will be needed for each plume (TFA, FWDA, or MW-1 area).

- Determine the optimal location for the final treatment system or systems based on future land use requirements.

3.2.4 Treated Water Discharge

The ROD specifies discharge of treated groundwater to the Willamette River in accordance with the substantive NPDES requirements or discharge to on-site drainfields installed in major source areas for augmentation of NAPL recovery. As discussed in Section 3.2.1, the final extraction well network and flow rates are currently unknown, but will be determined. The ROD assumed a treatment system flow rate of 30 gpm when developing the substantive NPDES requirements.

Subsequent investigations may indicate that greater flow rate may be necessary to attain the groundwater RAOs. The evaluation of treated water discharge to on-site drainfields will be investigated to determine whether this action would assist NAPL recovery. Therefore, technical issues that require resolution regarding treated water discharge include the following:

- Determine the adequacy of the existing NPDES discharge limits with respect to the final groundwater and NAPL extraction system.
- Determine the site specific percolation rates to allow evaluation of treated water discharge to drainfields.
- Determine the most effective and appropriate location(s) for an infiltration system and/or injection wells/trenches.

3.2.5 Off-site Treatment/Disposal of NAPL and Treatment Residuals

Technical issues that require resolution as part of implementation of the groundwater remedy include:

- Evaluation of waste minimization options;
- Amenability of waste NAPL to dewatering; and
- Evaluation of recovered NAPL recycling and/or reuse.

3.2.6 Compliance Monitoring

Compliance monitoring is required to determine whether the groundwater remedial action is achieving the RAOs specified in the ROD. The compliance program will be designed to monitor the discharge of treated water to the river, discharge of groundwater containing dissolved contaminants to the river, the vertical migration of NAPL to the deep aquifer, and discharges of NAPL to the river. Technical issues that require resolution as part of developing the groundwater compliance monitoring program include the following:

- Determine the appropriate location(s) for compliance monitoring wells with respect to the final extraction well network.

- Determine the measurement parameters to be collected from the monitoring wells.

- Determine a data evaluation method for NAPL migration.

4 Remedial Action Implementation Approach and Remedial Action Tasks

4.1 Remedial Action Implementation Approach

To implement the RA enhancements and achieve the groundwater RAOs, the major data gaps presented in Section 3 require investigation. E & E proposes to investigate these data gaps and implement the corresponding RA enhancements by completing the following major tasks: preparing and implementing data acquisition and evaluation plans, preparing RA enhancement design plans, procuring a remedial contractor to construct the groundwater RA enhancements, constructing and operating the remedial action enhancements, and monitoring and evaluating the enhancement actions.

E & E has prepared the flow chart in Figure 4-1 to present the proposed process for implementing RA enhancements. The following discussion provides an overview of E & E's approach.

E & E has divided the RA data acquisition and evaluation plans into two categories: aquifer-specific data and treatment system-specific data. E & E will prepare an Aquifer Investigation Plan (AQUIP) and a Biological Treatment Test Plan (BTTP) for each of these data types. The plans will identify specific data gaps and will present E & E's proposed investigative activities to fill the data gaps. In addition, the plans will describe the data evaluation and reporting requirements which E & E will complete.

E & E will prepare health and safety plans and sample and analysis plans as part of the AQUIP and BTTP. Following DEQ and EPA approval of the AQUIP, E & E will implement the activities described in the plan. If data gaps remain after implementation of the AQUIP, or if the data prove to be inconclusive, E & E will amend the plan to collect additional required information. Similarly, if the BTTP results indicate that implementation of biological treatment is not feasible, E & E will evaluate other technologies for groundwater treatment. The results of the aquifer investigation and biological treatment test will be presented by E & E in data summary and evaluation reports. Upon acceptance of the data

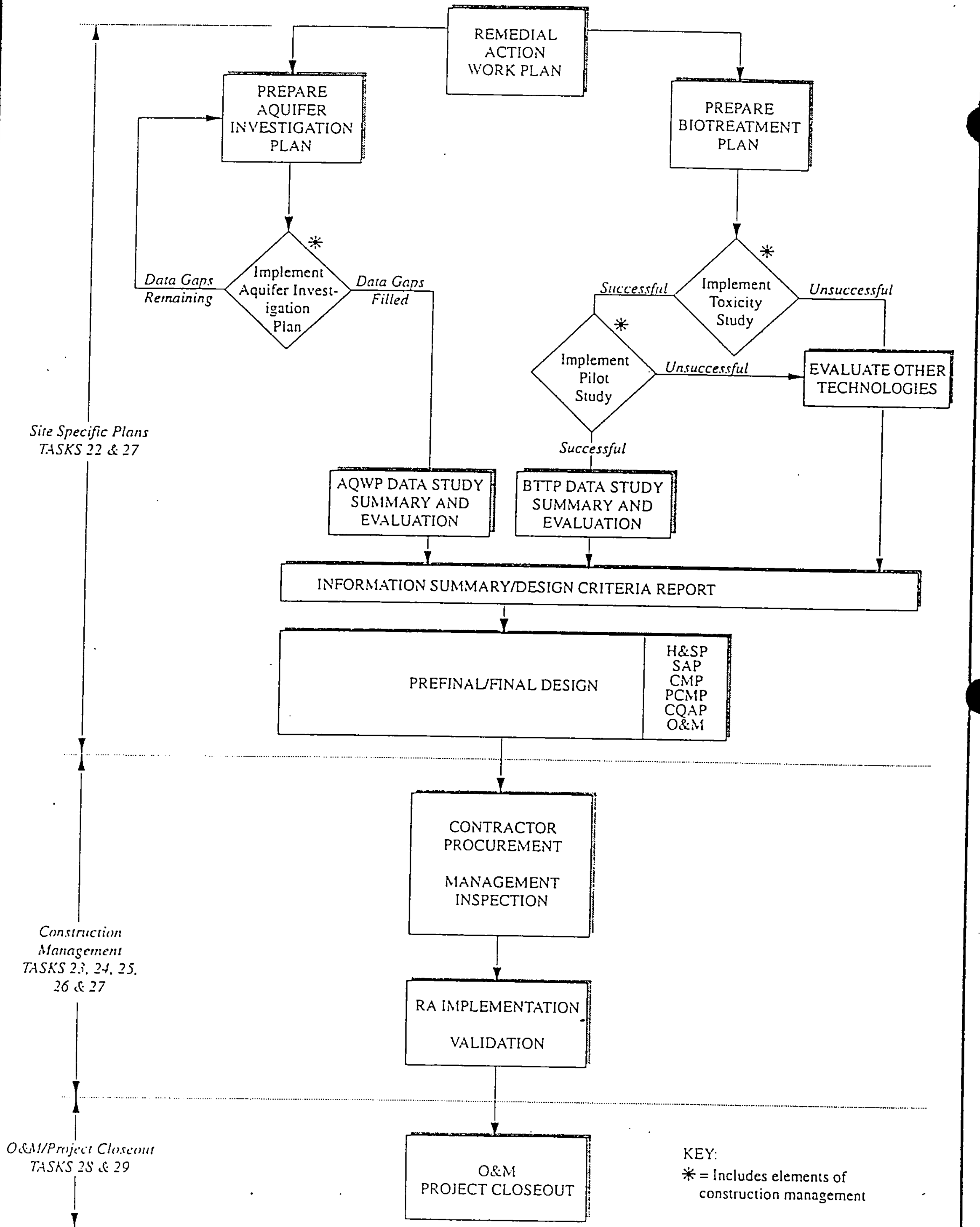

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Figure 4-1
GROUNDWATER RA IMPLEMENTATION APPROACH

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summary and evaluation reports, E & E will initiate preliminary design activities by preparing a design criteria report. The design criteria will utilize conclusions developed in the data summary and evaluation reports to establish the design parameters. The 30-percent design plans and specifications will be prepared following approval of the design criteria report. E & E will incorporate comments from the 30-percent design into the pre-final and final design plans and specifications. Upon acceptance of the final design plans and specifications, E & E will revise this RA Work Plan and will prepare the sample and analysis plan, construction management plan, draft operation and maintenance manual, pollution control and mitigation plan, and construction quality assurance plan.

E & E has assumed that implementation of innovative technologies (i.e., surfactant flushing, hot water/steam injection, etc.) would occur only after control of the NAPL plume zones is established in the source areas. This assumption dictates that data acquisition, evaluation, and pilot testing of innovative technologies for mobilizing NAPL would occur after effectiveness of the NAPL plume control action is demonstrated. E & E proposes that evaluation of innovative NAPL mobilizing technologies follow the same process shown in Figure 4-1.

4.2 Remedial Action Tasks

Nine tasks and four subtasks have been identified by DEQ in the Task Order (No. 64-93-23) Scope of Work to plan, execute, and track RA activities. These tasks are described below.

4.2.1 Task 21 - Remedial Action Project Planning and Support

The primary objective of RA planning is to determine how the site-specific RAOs, as specified in the ROD, will be met. The project planning task includes scoping meetings (the first scoping meeting was conducted on June 5, 1996, with DEQ and EPA), review and evaluation of existing information and data to identify data gaps, and preparation of this work plan and associated cost estimate.

E & E has conducted a review and analysis of existing data and documents, including the ROD, and identified project objectives, data gaps, and anticipated data needs to fill those gaps. These items are discussed in the following subtasks.

4.2.1.1 Subtask 21.1 - Scoping Meeting

E & E participated in the RA scoping meeting with DEQ and EPA on June 5, 1996, during which key aspects of project deliverables, including the work plan, budget proposal, and continuing RA activities, were discussed. E & E has assumed that up to two additional scoping meetings will be held to discuss the content of the AQUIP and BTTP.

4.2.1.2 Subtask 21.2 - Work Plan Development

Development of this RA Work Plan is being completed under this task. E & E has assumed that this draft Work Plan will be revised following receipt of DEQ and EPA comments. In addition, this RA Work Plan will be updated following approval of the Final RA Enhancement Design described in Section 4.3.2. E & E has assumed that separate RA Work Plans will be prepared for soil and sediment when the respective RD phases are completed.

4.2.1.3 Subtask 21.3 - Project Administration

This task involves providing overall project administration and coordination to maintain control over the technical and financial aspects of the RA activities under this task order. E & E will prepare monthly progress reports documenting the status of each task, and submit them to DEQ with the invoice. Monthly reporting procedures are described in Section 5.1. Other activities that will be conducted by E & E in this task include human and financial resource allocation, coordination of all project activities, timely communication with the DEQ project officer regarding project developments, and ensuring that quality of the project is maintained and work is completed within the authorized budget and schedule.

In addition, at DEQ's request, up to three E & E personnel will attend monthly status meetings with DEQ, EPA, and other technical team members to discuss RA progress, potential changes to project plans, potential problems and recommended solutions, and to exchange pertinent site information in a timely manner.

4.2.1.4 Subtask 21.4 - Community Relations

DEQ will prepare the Community Relations Plan (CRP) and be responsible for conducting community relations for the site. E & E will provide community relations support to DEQ, as appropriate, during RA activities. Potential support could include assisting in revising the CRP, addressing post-ROD significant changes (explanation of significant differences), preparing/reviewing fact sheets for RA activities, participating in briefings with the citizens' group WAKE-UP, providing schedule updates and notice of major site activities, and preparing a fact sheet, and potentially a public meeting, on the RA enhancement design. Other assistance may include preparing graphics or presentation material, presenting technical information to the public, or assisting DEQ with the logistics for a meeting.

4.2.2 Task 22 - Site-Specific Plans

The current requirements for this task, as defined in DEQ's Task Order 64-93-23, include preparation of the following site-specific plans: health and safety plan, sampling and analysis plan, construction management plan, operation and maintenance manual, pollution control and mitigation plan, and construction quality assurance plan. The purpose of these plans is to ensure proper implementation of the RAs in a manner consistent with the RAOs. However, before these plans are prepared for the groundwater RA enhancements, RA data acquisition plans will be prepared and implemented, and the RA enhancement design plans will be completed.

E & E will modify the existing health and safety plan (developed for RD soil data acquisition) to incorporate RA investigative activities. E & E proposes to delay development of the sampling and analysis plan, construction management plan, operation and maintenance manual, pollution control and mitigation plan, and the construction quality assurance plan. These document will be prepared by E & E after the RA enhancement design has been approved by DEQ and EPA. E & E will prepare these plans along with modifications to this Work Plan.

4.2.2.1 RA Data Acquisition Plans

Following approval of this RA Work Plan, E & E will begin development (under this task) of the AQUIP and the BTTP. These plans will be prepared as described in Section 4.2.2.1.1 and 4.2.2.1.2, respectively.

Each plan will describe data collection and sampling objectives, field activities, methodologies, and the analytical protocol. The plans will describe proposed sampling and investigatory activities, anticipated implementation difficulties, subcontractor work (as required), and will incorporate quality assurance/quality control (QA/QC) elements developed in accordance with the most recent available national and regional guidance specific to project data quality objectives (DQOs). In addition, the plans will identify laboratory QA objectives (i.e., accuracy, precision, completeness, comparability, and representativeness), corrective action measures, detection limits, and specific laboratory methodology. The plans will be used in the field as guidance for procedures to be followed for sample collection. The plans also will include a schedule for field activities, including a proposed schedule for securing subcontractors and coordinating with laboratories. The plans will describe any computer modeling activities that will be conducted by E & E. Each plan will include a description of the data summary report(s) that will be prepared by E & E following data acquisition. The summary report(s) will also contain E & E's evaluation of the data, recommendations, and conclusions. E & E will prepare the summary report(s) under this task.

E & E will manage all data gathered during RAs in accordance with the existing DEQ-approved Data Management Plan. All data generated during RAs will be entered into the pre-established database. Field and laboratory data collected by E & E will be incorporated into the database in either Microsoft Access and/or Geographic Information System (GIS) ArcInfo. AutoCAD will be utilized to develop data summary drawings. Existing digital files and site maps will be used to develop these drawings.

Spatial (latitude/longitude or northing/easting coordinates) and elevation/depth information for each sample location will also be incorporated into the database with the appropriate values for each distinct sample location.

In addition, a three-dimensional software program (GMS™) will be used to manipulate, conceptualize, and display data in a graphical environment. The database also will be capable of providing tabulated and formatted data to contouring, statistical, and GIS software programs.

4.2.2.1.1 Aquifer Investigation Plan

The AQUIP will outline the planned investigations to address the data gaps as presented in Section 3.2. The AQUIP will contain specific field procedures, measurement requirements, QA/QC procedures, and sampling requirements for data acquisition. The AQUIP will address all data gaps that currently exist. However, following data acquisition, amendments to the AQUIP may be required if the new data does not sufficiently address the data gaps. The AQUIP will contain the following sections:

- Development and Refinement of Site Conceptual Model
- Enhanced NAPL Extraction Testing and Evaluation
- Modeling of Groundwater and Fate and Transport of Contaminants
- Development of Performance Monitoring
- Determination and Evaluation of Alternate Extraction Methods

Development and Refinement of Site Conceptual Model

During the RI/FS, a site conceptual model was formulated that described the site conditions and mechanisms of contaminant transport. Several data gaps have been identified during ongoing RA groundwater activities and during the RA planning process that need to be evaluated. The site conceptual model will be revised and refined based on information acquired during the RA field activities.

In general, the conceptual site model development will include analysis of the following:

- Background information;
- Contaminant source and release information;
- Geologic and hydrologic information; and
- Contaminant distribution, transport, and fate parameters.

The conceptual site model will provide the basis for extraction tests at the site, groundwater treatment actions, modeling efforts associated with groundwater and NAPL fate and transport, three-dimensional site conceptualization, performance monitoring and evaluation, enhancement or augmentation of treatment systems, and future evaluation of modifications to the ROD and/or additional technical impracticality (if applicable).

Enhanced NAPL Extraction Testing and Evaluation

E & E has reviewed data previously collected during the RI/FS and subsequent phases of work and determined the need for additional information on optimal groundwater and enhanced NAPL removal rates.

E & E initially will confirm the estimated groundwater and NAPL pumping capacities achievable at a number of wells in the TFA and the FWDA. The recoveries in the pumping wells, NAPL/groundwater volume generated, and any drawdowns in observation wells will be used to determine optimal extraction methods, pumping rates, and capture zones for individual wells. These results will be used to recommend an optimal recovery well configuration and flow rates for NAPL plume control using the existing well configuration.

Modeling of Groundwater and Fate and Transport of Contaminants

Modeling will be performed to investigate the flow and transport of groundwater, contaminants in the subsurface to wells as part of the overall extraction system, the site boundaries, and the river. A calibrated flow and solute transport models may be used to predict future concentrations of contaminants, with the results used in an environmental fate analysis and subsequent future remedial action design activities.

Groundwater, contaminant concentration, and stratigraphic data obtained during the RI/FS, operation of the extraction system, previous NAPL testing and extraction activities, and supplemental investigations to be completed as part of the data gap analysis will be utilized to characterize the site hydrogeologic conditions. Groundwater and fate and transport modeling are expected to be completed using the MODFLOW, MODPATH, MT3D, and UTCHEM computer codes.

The following general steps will be used to develop the groundwater and contaminant transport models:

- Refinement and development of the conceptual model;
- Model data compilation and preparation;
- Groundwater model calibration and sensitivity analysis;
- Fate and transport conceptualization and data compilation;
- Fate and transport model calibration; and
- Fate and transport and RA simulations.

Development of Performance Monitoring

Monitoring criteria for the groundwater remedial action are divided in two categories: compliance monitoring and performance monitoring. Compliance monitoring at this site includes ensuring attainment of substantive NPDES requirements and ACL concentrations in compliance wells. The compliance monitoring strategy was discussed in Section 3.2.6.

Performance monitoring will be conducted to evaluate the effectiveness and provide guidance for optimization of the groundwater and enhanced NAPL extraction system in accordance with the established RAOs. The ROD specifies evaluation of the groundwater action at least every 5 years to confirm whether:

- Dissolved contaminant concentrations are decreasing over time;

- NAPL thicknesses are decreasing over time; and

- The estimated groundwater contaminant flux to the river is decreasing.

The performance monitoring program and evaluation criteria will be established prior to initiation of the groundwater remedial action. The performance criteria will establish benchmarks to evaluate the effectiveness of groundwater remedial action. As performance criteria measurements approach asymptotic values, an evaluation will be conducted to determine if system operation should be continued, or if another remedial technology should be considered, or if system operation should cease.

Evaluation of Alternate Extraction Methods

Concurrent with data gap field activities and investigations, E & E will investigate and determine the applicability of secondary enhanced extraction methods. Secondary extraction methods that are anticipated to be evaluated will include water and surfactant flooding techniques, hot water/steam injection, sheet piling or bentonite cut-off walls, etc.

It is anticipated that a thorough document and literature review will be conducted in order to identify technologies that have previously been utilized or have the potential to be implemented at a site with extensive NAPL contamination.

4.2.2.1.2 Biological Treatment Test Plan

The groundwater BTTP will consist of two components: a limited toxicity study and a pilot treatability study. The objective of the limited toxicity study is to validate the general approach of the biological remediation technique for treating organic site-specific contaminants. Specifically, the aim of the toxicity study is to identify any possible toxic effects to microorganisms present in the groundwater and to develop a bacterial culture capable of consuming site contaminants. The pilot treatability study will be conducted on a larger scale in the field. This treatability study will focus on collecting data for the final process design of a full-scale treatment system. Detailed protocols of the tests will be specified in the BTTP. The following describes, in general, the work associated with each study.

Toxicity Study

The BTTP will specify the materials that will be used as microbial sources (e.g., surface soil, recycled sludge from a Publicly Owned Treatment Works, commercially available BOD seed). The toxicity study will be carried out as batch experiments in a laboratory. Positive and negative controls will be performed simultaneously, and oxygen uptake rate measurements will be conducted for each test condition.

Successful completion of the toxicity study (i.e., viable culture readings as measured by oxygen uptake rates) will demonstrate lack of inherent microbial toxicity and permit advancement to the next phase, the pilot treatability study. If evidence of microbial toxicity is noted, E & E will evaluate other groundwater treatment technologies.

Pilot Treatability Study

The pilot treatability study portion of the BTTP will specify the location of the proposed study (i.e., TFA, FWDA, or both), the extraction wells, the flow rates/residence time proposed to be tested, the influent/effluent monitoring parameters, the criteria to be used for establishing steady-state conditions for each flow rate, the type of process equipment to be installed, the desired removal efficiency, and reporting requirements.

The pilot study will provide information on the influent and effluent characteristics such as pH, conductivity, temperature, contaminant concentrations, dissolved oxygen, BOD, nutrient needs and total suspended solids.

Based on this information and groundwater extraction rates, a scaled-up design will be developed incorporating the residence time, number of bioreactor units, nutrient addition requirements, proposed schematic, and cost estimates for the construction and O & M of the groundwater treatment system.

4.2.2.2 Groundwater Remedial Action Enhancement Plans

After completion of the RA data acquisition activities, E & E will prepare the following documents to design the RA enhancements. These documents will consist of technical engineering design plans and specifications for modifying and/or constructing the enhanced groundwater/NAPL extraction and treatment system. These engineering plans and specifications will be incorporated in the contract documents for the groundwater remedial contractor.

4.2.2.2.1 Preliminary Design Report

The preliminary design report will include a data summary and design criteria for the groundwater RA enhancements. The data summary section of the report will summarize the data, conclusions, and recommendations developed in the aquifer investigation summary report(s) and the biological treatment test summary report. The purpose of the data summary is to develop the design criteria parameters. The design criteria portion of the report will define the technical parameters on which the groundwater remedial action enhancements will be based. The design criteria report for groundwater will represent 10-percent design completion and will include the preliminary design assumptions and parameters.

Following approval of the data summary/design criteria report, E & E will prepare 30-percent engineering design plans and specifications. As part of the 30-percent design deliverable for groundwater, E & E will submit the following:

- A preliminary construction schedule;
- Specifications Outline, including all specifications sections to be used;
- Preliminary drawings;
- Basis of Design Report, including a detailed justification of design assumptions;
- Preliminary Cost Estimate (The preliminary RA cost estimate will include a preliminary evaluation of the costs of all the elements of the RAs. The estimate will be accurate within plus 50 percent and minus 30 percent and be prepared by using the M-CASES Gold Cost Estimating System for remedial action, or in an alternate format requested by DEQ.); and
- Description of variances with the ROD, if appropriate.

E & E will respond to all DEQ and EPA comments and incorporate changes in the pre-final design document.

4.2.2.2.2 Pre-Final and Final Design

E & E will incorporate comments received on the 30-percent design into the prefinal design plans and specifications for the groundwater RA enhancements. The prefinal design will serve as the draft version of the final design. After a review and comment on the prefinal design, the final design shall be submitted. All final design documents will be approved by a Professional Engineer registered in Oregon.

E & E will conduct the following activities:

- Prepare prefinal design specifications.
- Prepare prefinal drawings. The final submittals will include a complete set of construction drawings and specifications as well as a set of one-half size reductions of drawings. All specifications shall conform to CSI format.
- Prepare final basis of design report that incorporates any changes since the 30 percent design submittal.

- Prepare Revised RA enhancement cost estimate. E & E will prepare a definitive cost estimate for each work item from engineering data, within an accuracy of plus 15 percent to minus 5 percent using the M-CASES Gold Estimating System.

- Prepare 100 percent design submittal.

- Perform biddability, operability, and constructability reviews.

- Prepare revised project delivery strategy.

- Prepare draft O & M manual.

- Prepare construction quality assurance (CQA) plan. The CQA Plan will describe responsibilities of key personnel in construction, their qualifications, inspection activities, and sampling and documentation requirements.

E & E anticipates that the following set of plans will be developed:

Groundwater Remedial Action Enhancement
- Title Page, Site Location, and Drawing Index;
- Existing Site Plan;
- Proposed Site Plan;
- Civil Engineering Plans and Details;
- Mechanical Engineering Plans and Details; and
- Electrical Engineering Plans and Details.

In addition, E & E will support DEQ with pre-bid (pre-solicitation) activities, pre-award activities, and update site-specific plans, as necessary. The objective of this task is to assist DEQ with completing the contract bidding documents and preparing the invitation for bids. For cost and schedule estimating purposes, it is assumed that DEQ will advertise, evaluate, award, and directly contract with the successful bidder(s). E & E will assist DEQ with prebid (presolicitation) activities such as updating the general conditions or schedule, answering inquiries from bidders, conducting a site visit, and developing evaluation criteria.

4.2.3 Task 23 - Procurement of Construction Contractor

Under this task, E & E will procure groundwater RA data acquisition subcontractors and assist with the procurement of the groundwater RA enhancement construction contractor. At this time, E & E anticipates procurement of RA subcontractors for the following services: laboratory analysis, drilling, surveying, and biological treatment pilot testing.

Specific groundwater RA data acquisition subcontractor requirements, along with cost estimates, will be identified by E & E within the RA investigation plans prepared under Task

22. Under this task, E & E will develop detailed scopes of work and bid packages for subcontractor services, review and tabulate bids, and make award recommendations to DEQ.

Following DEQ and EPA acceptance of the final RA enhancement design, E & E will modify the activities to be conducted under this task to include support for procurement of the RA enhancement construction contractor.

4.2.4 Task 24 - Construction Contractor Management Support

E & E will provide management and oversight of subcontractors procured for groundwater RA data acquisition. E & E will conduct pre-field work conferences with subcontractors (as necessary) to organize, schedule, and plan the field work. E & E will review subcontractor submittals, product data, shop drawings, etc., as they pertain to the RA data acquisition field activities. E & E will review subcontractor requests for payment, provide subcontract interpretation, and negotiate change order requests, as necessary.

Following DEQ and EPA acceptance of the final RA enhancement design, E & E will modify the activities to be conducted under this task to include management support of the RA enhancement construction contractor.

4.2.5 Task 25 - Resident Inspection Services

For activities to be conducted as part of RA data acquisition, E & E will provide oversight of the subcontractors assisting E & E with field work conducted at site. Examples of subcontracted activities that E & E would oversee include drilling and biological treatment pilot tests. The level of oversight will be coordinated with the type of work being performed. The oversight activities will be conducted to verify that the work is performed in accordance with the subcontractor scopes of work. E & E will maintain detailed field log books of daily activities, review activities and monitor the project schedule, process change order requests, and conduct final inspections. The RA investigation plans (described in Task 22) will identify specific oversight and inspection requirements as they pertain to the proposed activities discussed in the plans.

Following DEQ and EPA acceptance of the final RA enhancement design, E & E will modify the activities to be conducted under this task to include resident engineering services for the duration of RA enhancement construction activities.

4.2.6 Task 26 - Cleanup Validation

E & E does not anticipate performing confirmation sampling to verify groundwater cleanup levels until after construction of the RA enhancements. E & E will describe the activities to be conducted under this task when this RA Work Plan is modified following acceptance of the groundwater RA enhancement design.

4.2.7 Task 27 - Remedial Action Implementation

E & E will continue implementation of the existing groundwater RAs under this task as described in E & E's Pre-Remedial Design Work Plan (E & E 1996a). The existing groundwater RAs will be conducted throughout the RA investigation and enhancement design activities.

4.2.8 Task 28 - Project Performance (Operation and Maintenance)

Following DEQ and EPA acceptance of the final RA enhancement design, E & E will modify the activities to be conducted under this task to include project performance evaluations and O & M of the groundwater RA enhancements.

4.2.9 Task 29 - Project Completion and Task Order Close-out

At the direction of DEQ, E & E will modify the groundwater RA Work Plan to include activities to be conducted under this task that pertain to project completion and task order close-out.

5 Reporting Requirements and Deliverables

5.1 Reporting Requirements

Pursuant to the contract, E & E will submit monthly progress reports describing the activities conducted during the period and planned activities for the subsequent reporting period. In accordance with the SOW, E & E will notify the DEQ Project Officer and Contract Specialist in writing whenever there is reason to believe that the costs that will be incurred in the next 60 days, when added to the costs previously incurred, will exceed 75 percent of the authorized task order budget, or that the total cost of performance, exclusive of any fee, will be greater or substantially less than had been previously estimated. In the event that there is a significant budget discrepancy, E & E will provide revised cost estimates to the DEQ Project Officer and Contract Specialist in writing.

Monthly progress reports will include a budget status report, a review of work performed during the previous month, scheduled activities by task for the upcoming reporting period, deliverables submitted, data collected, and subcontracting services utilized. In addition, if any problems are anticipated, recommended solutions will be presented. Any outstanding issues for the department also will be included.

5.2 Deliverables

Presented below is a list of deliverables that will be prepared for the groundwater RA phase of the project. A proposed schedule for delivery of the documents listed below as presented in Section 7.

REMEDIAL ACTION DELIVERABLES McCormick & Baxter Portland, Oregon
Draft/Final RA Work Plan and Cost Proposal
Draft/Final AQUIP and Cost Proposal
Draft/Final BTTP and Cost Proposal
Draft/Final AQUIP Data Summary Report
Draft/Final BTTP Data Summary Report
Design Criteria Report
30 percent Design Plans, Specifications, and Cost Estimate
Pre-Final Design Plans, Specifications, and Cost Estimate
Final Design Plans, Specifications, and Cost Estimate
Revised RA Work Plan, Health and Safety Plan, Sample and Analysis Plan, Construction Management Plan, Draft Operation and Maintenance Manual, Pollution Control and Mitigation Plan, Construction Quality Assurance Plan.

All deliverables will be submitted in draft form and a final document will be submitted after receipt of DEQ comments. The Design Criteria Report and 30-percent Design Plans and Specification are an exception is DEQ comments will be incorporated in the subsequent document. Pursuant to the SOW, the following number of copies will be submitted:

Recipient	Number of copies
Bill Dana, Project Officer	1 unbound and 6 bound (draft and final)
Steve Campbell, Project Specialist	1 unbound (draft) 1 bound (final)

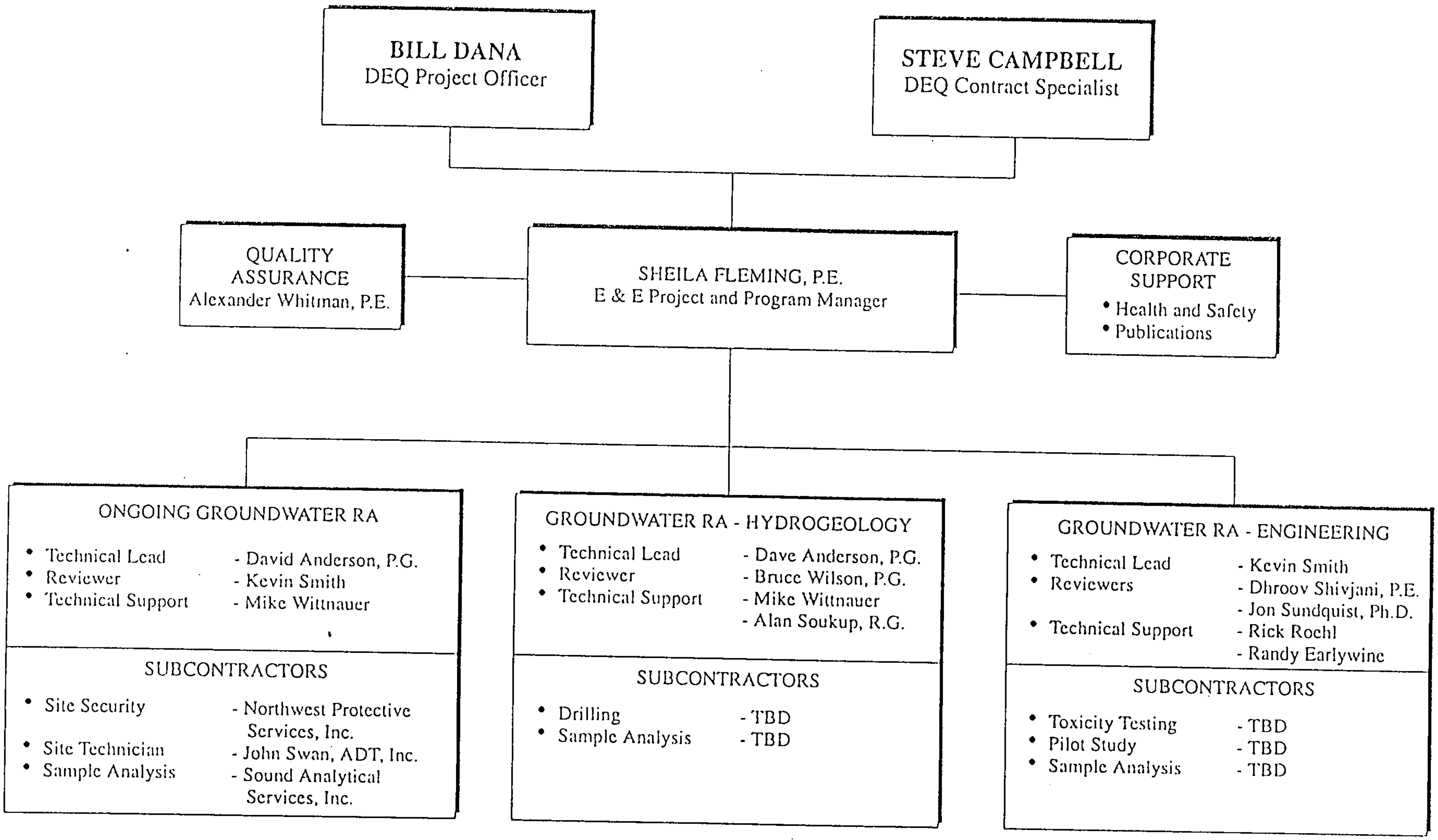
6 Project Organization

Project management and lines of authority for aspects of work associated with the RA phase for the McCormick & Baxter site are illustrated in Figure 6-1. Additional information related to project responsibilities and E & E's QA organization is discussed below.

Program/Project Manager

As the Program Manager and designated Project Manager for this site, Sheila Fleming has overall responsibility for ensuring that work on the Site meets client objectives and contract requirements. In addition, she is responsible for implementing the project and has the authority to commit the resources necessary to meet project objectives. Ms Fleming's primary function is to ensure that technical, financial, and scheduling objectives are achieved successfully. The Project Manager will report directly to Bill Dana, DEQ's Project Officer and is the primary point of contact and control for matters concerning the project. The Project Manager will:

- Assemble a project team who will define project objectives and implement project tasks;
- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task;
- Acquire and apply technical and corporate resources as needed to ensure performance within budget and schedule;
- Develop, track, and control project budgets and schedules and prepares all cost proposals for submittal to DEQ;
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product;
- Ensure that E & E project personnel and subcontractors are aware of project objectives;



KEY: TBD = To Be Determined

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FIGURE 6-1
GROUNDWATER RA
PROJECT ORGANIZATION CHART

Drawn By:	Date	IDD/Job No.	Dwg. No.
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- Review the work performed on each task to ensure its quality, responsiveness, and timeliness;

- Review and analyze overall task performance with respect to planned requirements and authorizations;

- Approve all external reports (deliverables) before their submission to DEQ; and

- Represent the project team at meetings and public hearings.

Technical Lead and Support Staff

E & E has identified three key areas associated with groundwater RA enhancement activities. Each area has been assigned a technical lead who will be responsible for coordinating and implementing the day-to-day project activities. The technical lead and technical support staff will be responsible for preparing planning documents, gathering and analyzing data, preparing required reports, providing field oversight of subcontractors, and ensuring that required field activities are conducted. All technical lead personnel will report directly to the Project Manager. Representative technical lead member responsibilities include:

- Coordination with the Project Manager on day-to-day technical issues in specific areas of expertise;

- Development and implementation of the work plan and technical memoranda to adhere to DEQ-approved project requirements;

- Adherence to work schedules provided by the Project Manager;

- Coordination of technical efforts of subcontractors assisting the team;

- Identification of problems at the team level, discuss resolutions with the Project Manager, and provide communication between team and upper management; and

- Participation in the preparation of project deliverables and reports.

Specific technical lead members and their primary responsibilities are provided below:

- Kevin Smith is the project mechanical engineer responsible for performing groundwater RA enhancement design activities including BTTP development, plans and specification development, supervising operation of the pilot groundwater treatment system, collecting design data, preparing engineering-related technical reports, providing oversight of treatment system subcontractor and laboratory, and addressing DEQ issues related to engineering activities at the site.

- David Anderson, P.G., is the project hydrogeologist responsible for performing/directing routine NAPL extraction, quarterly groundwater sample collection, and hydrogeologic studies at the site. He is also responsible for developing and implementing the AQUIP and associated reports, providing oversight of subcontractors (e.g., drillers), and addressing DEQ issues related to groundwater contamination, NAPL migration, and other relevant activities at the site. Mr. Anderson is also responsible for coordinating data collection needs with project engineers and developing and maintaining the project database.

- Dhroov Shivjiani, P.E., is a senior design engineer responsible for remedial design and preparing/reviewing technical reports. Mr. Shivjiani will play a key role in developing the plans and specifications for remedial action at the site and ensuring the quality of site-specific engineering activities and designs.

- Jon Sundquist, Ph.D. provides groundwater biological treatment expertise. Mr. Sundquist will provide key input during development and implementation of the BTTP and scaleup activities associated with RA enhancement.

- Bruce Wilson, P.G. is a senior groundwater modeling expert who will provide peer review during development of the AQUIP, conceptual site model parameters, evaluation of pump test data, and preparation of conclusions.

The technical lead members will be supported by technical staff, as indicated in Figure 6-1.

Quality Assurance

Alexander Whitman, P.E., Manager of Engineering for E & E's Western Division, is responsible for monitoring, documenting the quality of all work produced by the project team, and approving all plans and specifications. The fundamental goal of this position is to ensure that adequate technical resources are available to the Project Manager and that all documents meet project-specific QA standards.

7 Schedule

7.1 Schedule

A proposed schedule for groundwater RA activities, field investigations, and deliverables is presented in Figure 7-1 and milestones are listed in Table 7-1. No activities will be performed without authorization from DEQ. The project schedule assumes that data collected to fill RA data gaps will be received from the respective laboratory within 30 days of sample collection. In accordance with the SOW, it is assumed that comments will be received within 21 calendar days after submittal of deliverables to DEQ. Field activity schedule refinements will be included in the AQUIP and BTTP.

7.2 Costs

The anticipated costs to perform the activities described in this work plan are presented in a budget and assumptions proposal submitted under separate cover with this document. This proposal includes the estimated costs and assumptions for all tasks included in this work plan that can be reasonably estimated at this time. For example, costs and budget assumptions associated with RA data acquisition and enhancement design work will be presented in a proposal accompanying the AQUIP and BTTP. Although costs are provided for activities that are scheduled beyond the current task order end date of February 28, 1997 and the contract expiration date is March 17, 1997, it is assumed that DEQ will withhold authorization for these tasks until the task order end date is extended or until a new contract is issued by DEQ.

Table 7-1

PROPOSED SCHEDULE OF RD ACTIVITIES AND DELIVERABLES
McCormick & Baxter
Portland, Oregon

Activity/Deliverable	Anticipated Date[a]
Submit Draft RA Work Plan and Proposal	December 13, 1996
Receive DEQ Comments	January 10, 1997
Submit Final RA Work Plan and Cost Proposal	January 31, 1997
Current Task Order End Date	February 28, 1997
Submit Draft AQUIP	March 14, 1997
Receive DEQ Comments	April 7, 1997
Submit Final AQUIP	April 24, 1997
AQUIP Implementation Period	May 1, 1997 - August 29, 1997
Submit Draft BTTP	March 14, 1997
Receive DEQ Comments	April 7, 1997
Submit Final BTTP	April 21, 1997
BTTP Implementation Period	April 21, 1997 - August 29, 1997
Submit Draft AQUIP and BTTP Data Summary and Evaluation Reports	October 6, 1997
Receive DEQ Comments on AQUIP and BTTP Reports	October 27, 1997
Submit Design Criteria Report	December 19, 1997
Receive DEQ Comments	January 19, 1998
Submit Preliminary (30%) Design Documents - Groundwater Enhancements	February 27, 1998
Receive DEQ Comments	March 23, 1998
Submit Prefinal Design Plans and Specifications - Groundwater Enhancements	April 30, 1998
Receive DEQ Comments	May 29, 1998
Submit Final Basis of Design Report	June 30, 1998
Submit Revised RA Cost Estimate	June 30, 1998
Submit Final Plans and Specifications	June 30, 1998

a The current task order end date is February 28, 1997. No work will be conducted after this date unless a task order extension is issued by DEQ.

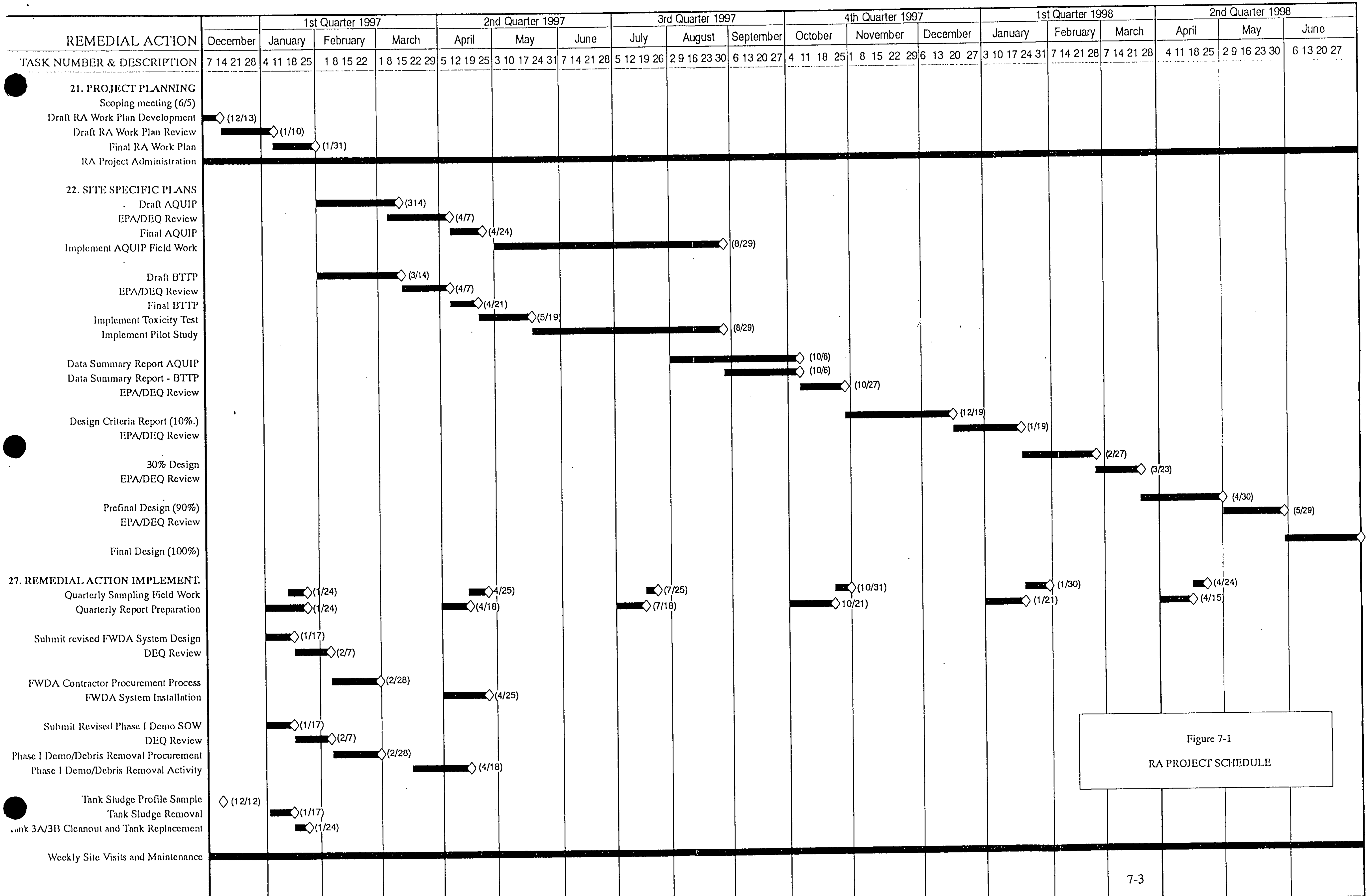

Figure 7-1

RA PROJECT SCHEDULE

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